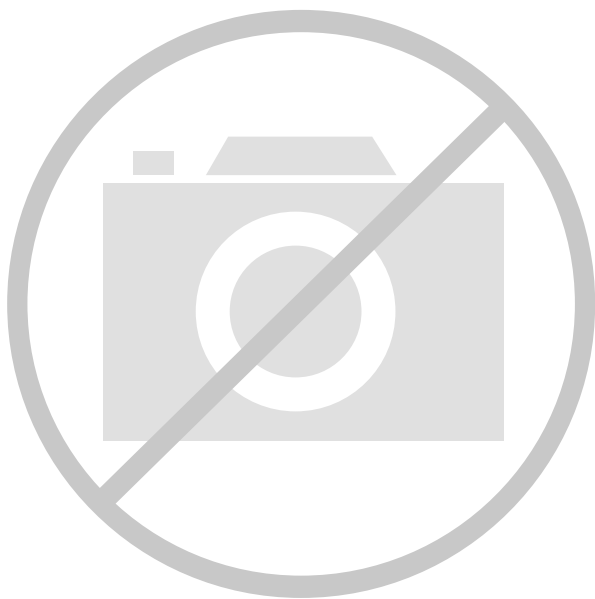




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### Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

### Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

#### Details

|                                |                                                                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status                 | Active                                                                                                                                                              |
| Number of LABs/CLBs            | -                                                                                                                                                                   |
| Number of Logic Elements/Cells | -                                                                                                                                                                   |
| Total RAM Bits                 | 147456                                                                                                                                                              |
| Number of I/O                  | 97                                                                                                                                                                  |
| Number of Gates                | 1000000                                                                                                                                                             |
| Voltage - Supply               | 1.425V ~ 1.575V                                                                                                                                                     |
| Mounting Type                  | Surface Mount                                                                                                                                                       |
| Operating Temperature          | -55°C ~ 125°C (TJ)                                                                                                                                                  |
| Package / Case                 | 144-LBGA                                                                                                                                                            |
| Supplier Device Package        | 144-FPBGA (13x13)                                                                                                                                                   |
| Purchase URL                   | <a href="https://www.e-xfl.com/product-detail/microchip-technology/m1a3p1000-fg144m">https://www.e-xfl.com/product-detail/microchip-technology/m1a3p1000-fg144m</a> |

**A3P1000** – **1** **FG** **G** **144** **Y** **M**

**Part Number**

**Speed Grade**  
Blank = Standard  
1 = 15% Faster than Standard  
2 = 25% Faster than Standard

**Package Type**  
VQ = Very Thin Quad Flat Pack (0.5 mm pitch)  
FG = Fine Pitch Ball Grid Array (1.0 mm pitch)  
PQ = Plastic Quad Flat Pack (0.5 mm pitch)

**Lead-Free Packaging**  
Blank = Standard Packaging  
G = RoHS-Compliant (Green) Packaging

**Package Lead Count**

**Security Feature**  
Y = Device Includes License to Implement IP Based on the  
Cryptography Research, Inc. (CRI) Patent Portfolio

**Application (Temperature Range)**  
M = Military (–55°C to 125°C Junction Temperature)

**LICENSED DPA COUNTERMEASURES**

## Military ProASIC3/EL Devices

A3P250 = 250,000 System Gates  
A3PE600L= 600,000 System Gates  
A3P1000 = 1,000,000 System Gates  
A3PE3000L= 3,000,000 System Gates

### Military ProASIC3/EL Devices with ARM Cortex-M1

M1A3P1000 = 1,000,000 System Gates  
M1A3PE3000L = 3,000,000 System Gates

## Temperature Grade Offerings

| Package               | A3P250 | A3PE600L | A3P1000   | A3PE3000L   |
|-----------------------|--------|----------|-----------|-------------|
| ARM Cortex-M1 Devices |        |          | M1A3P1000 | M1A3PE3000L |
| VQ100                 | M      | –        | –         | –           |
| PQ208                 | –      | –        | M         | –           |
| FG144                 | –      | –        | M         | –           |
| FG256                 | –      | –        | M         | –           |
| FG484                 | –      | M        | M         | M           |
| FG896                 | –      | –        | –         | M           |

**Note:** M = Military temperature range:  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  junction temperature

### Combinatorial Cells Contribution— $P_{C-CELL}$

$$P_{C-CELL} = N_{C-CELL} * \alpha_1 / 2 * PAC7 * F_{CLK}$$

$N_{C-CELL}$  is the number of VersaTiles used as combinatorial modules in the design.

$\alpha_1$  is the toggle rate of VersaTile outputs—guidelines are provided in [Table 2-23 on page 2-17](#).

$F_{CLK}$  is the global clock signal frequency.

### Routing Net Contribution— $P_{NET}$

$$P_{NET} = (N_{S-CELL} + N_{C-CELL}) * \alpha_1 / 2 * PAC8 * F_{CLK}$$

$N_{S-CELL}$  is the number of VersaTiles used as sequential modules in the design.

$N_{C-CELL}$  is the number of VersaTiles used as combinatorial modules in the design.

$\alpha_1$  is the toggle rate of VersaTile outputs—guidelines are provided in [Table 2-23 on page 2-17](#).

$F_{CLK}$  is the global clock signal frequency.

### I/O Input Buffer Contribution— $P_{INPUTS}$

$$P_{INPUTS} = N_{INPUTS} * \alpha_2 / 2 * PAC9 * F_{CLK}$$

$N_{INPUTS}$  is the number of I/O input buffers used in the design.

$\alpha_2$  is the I/O buffer toggle rate—guidelines are provided in [Table 2-23 on page 2-17](#).

$F_{CLK}$  is the global clock signal frequency.

### I/O Output Buffer Contribution— $P_{OUTPUTS}$

$$P_{OUTPUTS} = N_{OUTPUTS} * \alpha_2 / 2 * \beta_1 * PAC10 * F_{CLK}$$

$N_{OUTPUTS}$  is the number of I/O output buffers used in the design.

$\alpha_2$  is the I/O buffer toggle rate—guidelines are provided in [Table 2-23 on page 2-17](#).

$\beta_1$  is the I/O buffer enable rate—guidelines are provided in [Table 2-24 on page 2-17](#).

$F_{CLK}$  is the global clock signal frequency.

### RAM Contribution— $P_{MEMORY}$

$$P_{MEMORY} = PAC11 * N_{BLOCKS} * F_{READ-CLOCK} * \beta_2 + PAC12 * N_{BLOCK} * F_{WRITE-CLOCK} * \beta_3$$

$N_{BLOCKS}$  is the number of RAM blocks used in the design.

$F_{READ-CLOCK}$  is the memory read clock frequency.

$\beta_2$  is the RAM enable rate for read operations.

$F_{WRITE-CLOCK}$  is the memory write clock frequency.

$\beta_3$  is the RAM enable rate for write operations—guidelines are provided in [Table 2-24 on page 2-17](#).

### PLL Contribution— $P_{PLL}$

$$P_{PLL} = PDC4 + PAC13 * F_{CLKOUT}$$

$F_{CLKOUT}$  is the output clock frequency.<sup>1</sup>

1. If a PLL is used to generate more than one output clock, include each output clock in the formula by adding its corresponding contribution ( $PAC13 * F_{CLKOUT}$  product) to the total PLL contribution.

**Table 2-54 • 3.3 V LVTTTL / 3.3 V LVCMOS Low Slew**  
**Military-Case Conditions:  $T_J = 125^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 3.0 V**  
**Applicable to Advanced I/O Banks**

| Drive Strength | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | $t_{ZLS}$ | $t_{ZHS}$ | Units |
|----------------|-------------|------------|----------|-----------|----------|------------|----------|----------|----------|----------|-----------|-----------|-------|
| 4 mA           | Std.        | 0.63       | 6.25     | 0.05      | 1.12     | 0.45       | 6.37     | 5.29     | 2.91     | 2.70     | 8.83      | 7.75      | ns    |
|                | –1          | 0.54       | 5.32     | 0.04      | 0.95     | 0.39       | 5.42     | 4.50     | 2.47     | 2.30     | 7.51      | 6.59      | ns    |
| 6 mA           | Std.        | 0.63       | 5.25     | 0.05      | 1.12     | 0.45       | 5.35     | 4.58     | 3.28     | 3.34     | 7.81      | 7.04      | ns    |
|                | –1          | 0.54       | 4.47     | 0.04      | 0.95     | 0.39       | 4.55     | 3.90     | 2.79     | 2.85     | 6.65      | 5.99      | ns    |
| 8 mA           | Std.        | 0.63       | 5.25     | 0.05      | 1.12     | 0.45       | 5.35     | 4.58     | 3.28     | 3.34     | 7.81      | 7.04      | ns    |
|                | –1          | 0.54       | 4.47     | 0.04      | 0.95     | 0.39       | 4.55     | 3.90     | 2.79     | 2.85     | 6.65      | 5.99      | ns    |
| 12 mA          | Std.        | 0.63       | 4.50     | 0.05      | 1.12     | 0.45       | 4.59     | 4.05     | 3.53     | 3.76     | 7.05      | 6.51      | ns    |
|                | –1          | 0.54       | 3.83     | 0.04      | 0.95     | 0.39       | 3.90     | 3.45     | 3.00     | 3.20     | 5.99      | 5.54      | ns    |
| 16 mA          | Std.        | 0.63       | 4.27     | 0.05      | 1.12     | 0.45       | 4.35     | 3.93     | 3.58     | 3.86     | 6.81      | 6.39      | ns    |
|                | –1          | 0.54       | 3.63     | 0.04      | 0.95     | 0.39       | 3.70     | 3.34     | 3.05     | 3.29     | 5.79      | 5.43      | ns    |
| 24 mA          | Std.        | 0.63       | 4.14     | 0.05      | 1.12     | 0.45       | 4.22     | 3.97     | 3.65     | 4.27     | 6.68      | 6.43      | ns    |
|                | –1          | 0.54       | 3.53     | 0.04      | 0.95     | 0.39       | 3.59     | 3.38     | 3.10     | 3.63     | 5.68      | 5.47      | ns    |

*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-7 on page 2-6](#) for derating values.

**Table 2-55 • 3.3 V LVTTTL / 3.3 V LVCMOS High Slew**  
**Military-Case Conditions:  $T_J = 125^\circ\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 3.0 V**  
**Applicable to Advanced I/O Banks**

| Drive Strength | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | $t_{ZLS}$ | $t_{ZHS}$ | Units |
|----------------|-------------|------------|----------|-----------|----------|------------|----------|----------|----------|----------|-----------|-----------|-------|
| 4 mA           | Std.        | 0.63       | 3.55     | 0.05      | 1.12     | 0.45       | 3.62     | 2.79     | 2.91     | 2.87     | 6.07      | 5.25      | ns    |
|                | –1          | 0.54       | 3.02     | 0.04      | 0.95     | 0.39       | 3.08     | 2.37     | 2.48     | 2.44     | 5.17      | 4.46      | ns    |
| 6 mA           | Std.        | 0.63       | 2.95     | 0.05      | 1.12     | 0.45       | 3.00     | 2.25     | 3.28     | 3.52     | 5.46      | 4.71      | ns    |
|                | –1          | 0.54       | 2.51     | 0.04      | 0.95     | 0.39       | 2.55     | 1.91     | 2.79     | 3.00     | 4.65      | 4.01      | ns    |
| 8 mA           | Std.        | 0.63       | 2.95     | 0.05      | 1.12     | 0.45       | 3.00     | 2.25     | 3.28     | 3.52     | 5.46      | 4.71      | ns    |
|                | –1          | 0.54       | 2.51     | 0.04      | 0.95     | 0.39       | 2.55     | 1.91     | 2.79     | 3.00     | 4.65      | 4.01      | ns    |
| 12 mA          | Std.        | 0.63       | 2.64     | 0.05      | 1.12     | 0.45       | 2.68     | 1.99     | 3.53     | 3.94     | 5.14      | 4.45      | ns    |
|                | –1          | 0.54       | 2.24     | 0.04      | 0.95     | 0.39       | 2.28     | 1.70     | 3.00     | 3.35     | 4.38      | 3.79      | ns    |
| 16 mA          | Std.        | 0.63       | 2.58     | 0.05      | 1.12     | 0.45       | 2.63     | 1.95     | 3.59     | 4.05     | 5.09      | 4.41      | ns    |
|                | –1          | 0.54       | 2.20     | 0.04      | 0.95     | 0.39       | 2.24     | 1.66     | 3.05     | 3.44     | 4.33      | 3.75      | ns    |
| 24 mA          | Std.        | 0.63       | 2.61     | 0.05      | 1.12     | 0.45       | 2.66     | 1.89     | 3.66     | 4.46     | 5.12      | 4.35      | ns    |
|                | –1          | 0.54       | 2.22     | 0.04      | 0.95     | 0.39       | 2.26     | 1.61     | 3.11     | 3.80     | 4.35      | 3.70      | ns    |

**Notes:**

1. Software default selection highlighted in gray.
2. For specific junction temperature and voltage supply levels, refer to [Table 2-7 on page 2-6](#) for derating values.



### 3.3 V LVCMOS Wide Range

**Table 2-58 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Pro I/O Banks for A3PE600L and A3PE3000L Only

| 3.3 V LVCMOS Wide Range | Equiv. Software Default Drive Strength Option <sup>1</sup> | VIL    |        | VIH    |        | VOL    | VOH        | IOL | IOH | IOSL                 | IOSH                 | IIL <sup>2</sup> | IIH <sup>3</sup> |
|-------------------------|------------------------------------------------------------|--------|--------|--------|--------|--------|------------|-----|-----|----------------------|----------------------|------------------|------------------|
| Drive Strength          |                                                            | Min. V | Max. V | Min. V | Max. V | Max. V | Min. V     | μA  | μA  | Max. mA <sup>4</sup> | Max. mA <sup>4</sup> | μA <sup>5</sup>  | μA <sup>5</sup>  |
| 100 μA                  | 2 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 25                   | 27                   | 15               | 15               |
| 100 μA                  | 4 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 25                   | 27                   | 15               | 15               |
| 100 μA                  | 6 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 51                   | 54                   | 15               | 15               |
| 100 μA                  | 12 mA                                                      | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 103                  | 109                  | 15               | 15               |
| 100 μA                  | 16 mA                                                      | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 132                  | 127                  | 15               | 15               |
| 100 μA                  | 24 mA                                                      | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 268                  | 181                  | 15               | 15               |

**Notes:**

- Note that 3.3 V LVCMOS wide range is applicable to 100 μA drive strength only. The configuration will not operate at the equivalent software default drive strength. These values are for normal ranges only.
- I<sub>IL</sub> is the input leakage current per I/O pin over recommended operation conditions where −0.3 V < V<sub>IN</sub> < V<sub>IL</sub>.
- I<sub>IH</sub> is the input leakage current per I/O pin over recommended operating conditions V<sub>IH</sub> < V<sub>IN</sub> < V<sub>CCI</sub>. Input current is larger when operating outside recommended ranges
- Currents are measured at 125°C junction temperature.
- All LVCMOS 3.3 V software macros support LVCMOS 3.3 V wide range as specified in the JESD8-A specification.
- Software default selection highlighted in gray.

**Table 2-59 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 3.3 V LVCMOS Wide Range | Equiv. Software Default Drive Strength Option <sup>1</sup> | VIL    |        | VIH    |        | VOL    | VOH        | IOL | IOH | IOSL                 | IOSH                 | IIL <sup>2</sup> | IIH <sup>3</sup> |
|-------------------------|------------------------------------------------------------|--------|--------|--------|--------|--------|------------|-----|-----|----------------------|----------------------|------------------|------------------|
| Drive Strength          |                                                            | Min. V | Max. V | Min. V | Max. V | Max. V | Min. V     | μA  | μA  | Max. mA <sup>4</sup> | Max. mA <sup>4</sup> | μA <sup>5</sup>  | μA <sup>5</sup>  |
| 100 μA                  | 2 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 25                   | 27                   | 15               | 15               |
| 100 μA                  | 4 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 25                   | 27                   | 15               | 15               |
| 100 μA                  | 6 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 51                   | 54                   | 15               | 15               |
| 100 μA                  | 8 mA                                                       | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 51                   | 54                   | 15               | 15               |
| 100 μA                  | 12 mA                                                      | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 103                  | 109                  | 15               | 15               |
| 100 μA                  | 16 mA                                                      | −0.3   | 0.8    | 2      | 3.6    | 0.2    | VCCI − 0.2 | 100 | 100 | 132                  | 127                  | 15               | 15               |

**Notes:**

- Note that 3.3 V LVCMOS wide range is applicable to 100 μA drive strength only. The configuration will NOT operate at the equivalent software default drive strength. These values are for Normal Ranges ONLY.
- I<sub>IL</sub> is the input leakage current per I/O pin over recommended operation conditions where −0.3 V < V<sub>IN</sub> < V<sub>IL</sub>.
- I<sub>IH</sub> is the input leakage current per I/O pin over recommended operating conditions V<sub>IH</sub> < V<sub>IN</sub> < V<sub>CCI</sub>. Input current is larger when operating outside recommended ranges
- Currents are measured at 125°C junction temperature.
- All LVCMOS 3.3 V software macros support LVCMOS 3.3 V wide range as specified in the JESD8-A specification.
- Software default selection highlighted in gray.

## 2.5 V LVCMOS

Low-Voltage CMOS for 2.5 V is an extension of the LVCMOS standard (JESD8-5) used for general-purpose 2.5 V applications.

**Table 2-70 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Pro I/Os for A3PE600L and A3PE3000L Only

| 2.5 V LVCMOS   | VIL       |           | VIH       |           | VOL       | VOH       | IOL | IOH | IOSL                    | IOSH                    | IIL <sup>1</sup> | IIH <sup>2</sup> |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|-----|-------------------------|-------------------------|------------------|------------------|
| Drive Strength | Min.<br>V | Max.<br>V | Min.<br>V | Max.<br>V | Max.<br>V | Min.<br>V | mA  | mA  | Max.<br>mA <sup>3</sup> | Max.<br>mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>  |
| 4 mA           | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 4   | 4   | 16                      | 18                      | 15               | 15               |
| 8 mA           | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 8   | 8   | 32                      | 37                      | 15               | 15               |
| 12 mA          | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 12  | 12  | 65                      | 74                      | 15               | 15               |
| 16 mA          | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 16  | 16  | 83                      | 87                      | 15               | 15               |
| 24 mA          | −0.3      | 0.7       | 1.7       | 3.6       | 0.7       | 1.7       | 24  | 24  | 169                     | 124                     | 15               | 15               |

### Notes:

1.  $I_{IL}$  is the input leakage current per I/O pin over recommended operation conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .
2.  $I_{IH}$  is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended ranges
3. Currents are measured at 100°C junction temperature and maximum voltage.
4. Currents are measured at 125°C junction temperature.
5. Software default selection highlighted in gray.

**Table 2-71 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Advanced I/O Banks

| 2.5 V LVCMOS   | VIL       |           | VIH       |           | VOL       | VOH       | IOL | IOH | IOSL                    | IOSH                    | IIL <sup>1</sup> | IIH <sup>2</sup> |
|----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|-----|-------------------------|-------------------------|------------------|------------------|
| Drive Strength | Min.<br>V | Max.<br>V | Min.<br>V | Max.<br>V | Max.<br>V | Min.<br>V | mA  | mA  | Max.<br>mA <sup>3</sup> | Max.<br>mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>  |
| 2 mA           | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 2   | 2   | 16                      | 18                      | 15               | 15               |
| 4 mA           | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 4   | 4   | 16                      | 18                      | 15               | 15               |
| 6 mA           | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 6   | 6   | 32                      | 37                      | 15               | 15               |
| 8 mA           | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 8   | 8   | 32                      | 37                      | 15               | 15               |
| 12 mA          | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 12  | 12  | 65                      | 74                      | 15               | 15               |
| 16 mA          | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 16  | 16  | 83                      | 87                      | 15               | 15               |
| 24 mA          | −0.3      | 0.7       | 1.7       | 2.7       | 0.7       | 1.7       | 24  | 24  | 169                     | 124                     | 15               | 15               |

### Notes:

1.  $I_{IL}$  is the input leakage current per I/O pin over recommended operation conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .
2.  $I_{IH}$  is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended ranges
3. Currents are measured at 100°C junction temperature and maximum voltage.
4. Currents are measured at 125°C junction temperature.
5. Software default selection highlighted in gray.

### 1.5 V DC Core Voltage

**Table 2-88 • 1.8 V LVCMOS Low Slew**

Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ ,  $V_{CC} = 1.425\text{ V}$ , Worst-Case  $V_{CCI} = 1.7\text{ V}$ 

Applicable to Pro I/Os for A3PE600L and A3PE3000L Only

| Drive Strength | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{PYS}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | $t_{ZLS}$ | $t_{ZHS}$ | Units |
|----------------|-------------|------------|----------|-----------|----------|-----------|------------|----------|----------|----------|----------|-----------|-----------|-------|
| 2 mA           | Std.        | 0.61       | 9.02     | 0.04      | 1.69     | 2.52      | 0.40       | 9.17     | 7.57     | 2.61     | 1.01     | 10.63     | 9.04      | ns    |
|                | –1          | 0.52       | 7.68     | 0.03      | 1.44     | 2.14      | 0.34       | 7.80     | 6.44     | 2.22     | 0.86     | 9.04      | 7.69      | ns    |
| 4 mA           | Std.        | 0.61       | 7.41     | 0.04      | 1.69     | 2.52      | 0.40       | 7.52     | 6.36     | 3.07     | 2.56     | 8.99      | 7.83      | ns    |
|                | –1          | 0.52       | 6.30     | 0.03      | 1.44     | 2.14      | 0.34       | 6.40     | 5.41     | 2.62     | 2.18     | 7.64      | 6.66      | ns    |
| 6 mA           | Std.        | 0.61       | 6.26     | 0.04      | 1.69     | 2.52      | 0.40       | 6.35     | 5.53     | 3.38     | 3.14     | 7.82      | 7.00      | ns    |
|                | –1          | 0.52       | 5.33     | 0.03      | 1.44     | 2.14      | 0.34       | 5.40     | 4.71     | 2.88     | 2.67     | 6.65      | 5.95      | ns    |
| 8 mA           | Std.        | 0.61       | 5.88     | 0.04      | 1.69     | 2.52      | 0.40       | 5.96     | 5.37     | 3.45     | 3.30     | 7.42      | 6.83      | ns    |
|                | –1          | 0.52       | 5.00     | 0.03      | 1.44     | 2.14      | 0.34       | 5.07     | 4.57     | 2.94     | 2.81     | 6.32      | 5.81      | ns    |
| 12 mA          | Std.        | 0.61       | 5.76     | 0.04      | 1.69     | 2.52      | 0.40       | 5.85     | 5.38     | 3.55     | 3.88     | 7.31      | 6.84      | ns    |
|                | –1          | 0.52       | 4.90     | 0.03      | 1.44     | 2.14      | 0.34       | 4.97     | 4.57     | 3.02     | 3.30     | 6.22      | 5.82      | ns    |
| 16 mA          | Std.        | 0.61       | 5.76     | 0.04      | 1.69     | 2.52      | 0.40       | 5.85     | 5.38     | 3.55     | 3.88     | 7.31      | 6.84      | ns    |
|                | –1          | 0.52       | 4.90     | 0.03      | 1.44     | 2.14      | 0.34       | 4.97     | 4.57     | 3.02     | 3.30     | 6.22      | 5.82      | ns    |

*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-89 • 1.8 V LVCMOS High Slew**

Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ ,  $V_{CC} = 1.425\text{ V}$ , Worst-Case  $V_{CCI} = 1.7\text{ V}$ 

Applicable to Pro I/Os for A3PE600L and A3PE3000L Only

| Drive Strength | Speed Grade | $t_{DOUT}$ | $t_{DP}$ | $t_{DIN}$ | $t_{PY}$ | $t_{PYS}$ | $t_{EOUT}$ | $t_{ZL}$ | $t_{ZH}$ | $t_{LZ}$ | $t_{HZ}$ | $t_{ZLS}$ | $t_{ZHS}$ | Units |
|----------------|-------------|------------|----------|-----------|----------|-----------|------------|----------|----------|----------|----------|-----------|-----------|-------|
| 2 mA           | Std.        | 0.61       | 4.01     | 0.04      | 1.69     | 2.52      | 0.40       | 4.06     | 3.94     | 2.60     | 1.03     | 5.52      | 5.40      | ns    |
|                | –1          | 0.52       | 3.41     | 0.03      | 1.44     | 2.14      | 0.34       | 3.45     | 3.35     | 2.21     | 0.88     | 4.70      | 4.60      | ns    |
| 4 mA           | Std.        | 0.61       | 3.22     | 0.04      | 1.69     | 2.52      | 0.40       | 3.26     | 2.89     | 3.07     | 2.65     | 4.72      | 4.36      | ns    |
|                | –1          | 0.52       | 2.74     | 0.03      | 1.44     | 2.14      | 0.34       | 2.77     | 2.46     | 2.61     | 2.26     | 4.02      | 3.71      | ns    |
| 6 mA           | Std.        | 0.61       | 2.74     | 0.04      | 1.69     | 2.52      | 0.40       | 2.77     | 2.38     | 3.38     | 3.23     | 4.23      | 3.84      | ns    |
|                | –1          | 0.52       | 2.33     | 0.03      | 1.44     | 2.14      | 0.34       | 2.36     | 2.02     | 2.88     | 2.75     | 3.60      | 3.27      | ns    |
| 8 mA           | Std.        | 0.61       | 2.65     | 0.04      | 1.69     | 2.52      | 0.40       | 2.68     | 2.28     | 3.45     | 3.40     | 4.14      | 3.75      | ns    |
|                | –1          | 0.52       | 2.26     | 0.03      | 1.44     | 2.14      | 0.34       | 2.28     | 1.94     | 2.93     | 2.89     | 3.52      | 3.19      | ns    |
| 12 mA          | Std.        | 0.61       | 2.64     | 0.04      | 1.69     | 2.52      | 0.40       | 2.66     | 2.16     | 3.55     | 4.01     | 4.13      | 3.63      | ns    |
|                | –1          | 0.52       | 2.24     | 0.03      | 1.44     | 2.14      | 0.34       | 2.26     | 1.84     | 3.02     | 3.41     | 3.51      | 3.08      | ns    |
| 16 mA          | Std.        | 0.61       | 2.64     | 0.04      | 1.69     | 2.52      | 0.40       | 2.66     | 2.16     | 3.55     | 4.01     | 4.13      | 3.63      | ns    |
|                | –1          | 0.52       | 2.24     | 0.03      | 1.44     | 2.14      | 0.34       | 2.26     | 1.84     | 3.02     | 3.41     | 3.51      | 3.08      | ns    |

*Notes:*

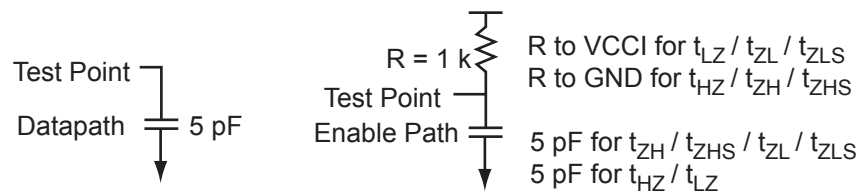
1. Software default selection highlighted in gray.
2. For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-96 • Minimum and Maximum DC Input and Output Levels**  
Applicable to Standard Plus I/O Banks

| 1.5 V<br>LVCMOS   | VIL       |             | VIH         |           | VOL         | VOH         | I <sub>OL</sub> | I <sub>OH</sub> | I <sub>OSL</sub>        | I <sub>OSH</sub>        | I <sub>IL</sub> <sup>1</sup> | I <sub>IH</sub> <sup>2</sup> |
|-------------------|-----------|-------------|-------------|-----------|-------------|-------------|-----------------|-----------------|-------------------------|-------------------------|------------------------------|------------------------------|
| Drive<br>Strength | Min.<br>V | Max.<br>V   | Min.<br>V   | Max.<br>V | Max.<br>V   | Min.<br>V   | mA              | mA              | Max.<br>mA <sup>3</sup> | Max.<br>mA <sup>3</sup> | μA <sup>4</sup>              | μA <sup>4</sup>              |
| 2 mA              | −0.3      | 0.35 * VCCI | 0.65 * VCCI | 1.575     | 0.25 * VCCI | 0.75 * VCCI | 2               | 2               | 13                      | 16                      | 15                           | 15                           |
| 4 mA              | −0.3      | 0.35 * VCCI | 0.65 * VCCI | 1.575     | 0.25 * VCCI | 0.75 * VCCI | 4               | 4               | 25                      | 33                      | 15                           | 15                           |

**Notes:**

1. I<sub>IL</sub> is the input leakage current per I/O pin over recommended operation conditions where −0.3 V < V<sub>IN</sub> < V<sub>IL</sub>.
2. I<sub>IH</sub> is the input leakage current per I/O pin over recommended operating conditions V<sub>IH</sub> < V<sub>IN</sub> < V<sub>CCI</sub>. Input current is larger when operating outside recommended ranges
3. Currents are measured at 100°C junction temperature and maximum voltage.
4. Currents are measured at 125°C junction temperature.
5. Software default selection highlighted in gray.



**Figure 2-11 • AC Loading**

**Table 2-97 • AC Waveforms, Measuring Points, and Capacitive Loads**

| Input Low (V) | Input High (V) | Measuring Point* (V) | VREF (Typ) (V) | C <sub>LOAD</sub> (pF) |
|---------------|----------------|----------------------|----------------|------------------------|
| 0             | 1.5            | 0.75                 | –              | 5                      |

**Note:** \*Measuring point = V<sub>trip</sub>. See Table 2-29 on page 2-25 for a complete table of trip points.

## HSTL Class I

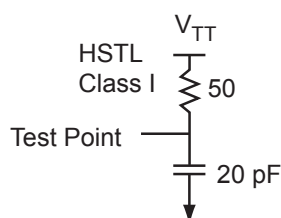
High-Speed Transceiver Logic is a general-purpose high-speed 1.5 V bus standard (EIA/JESD8-6). Military ProASIC3E devices support Class I. This provides a differential amplifier input buffer and a push-pull output buffer.

**Table 2-136 • Minimum and Maximum DC Input and Output Levels**

| HSTL Class I   | VIL    |            | VIH        |        | VOL    | VOH        | IOL | IOH | IOSL                 | IOSH                 | IIL <sup>1</sup> | I <sub>IH</sub> <sup>2</sup> |
|----------------|--------|------------|------------|--------|--------|------------|-----|-----|----------------------|----------------------|------------------|------------------------------|
| Drive Strength | Min. V | Max. V     | Min. V     | Max. V | Max. V | Min. V     | mA  | mA  | Max. mA <sup>3</sup> | Max. mA <sup>3</sup> | μA <sup>4</sup>  | μA <sup>4</sup>              |
| 8 mA           | −0.3   | VREF − 0.1 | VREF + 0.1 | 3.6    | 0.4    | VCCI − 0.4 | 8   | 8   | 32                   | 39                   | 15               | 15                           |

**Notes:**

1.  $I_{IL}$  is the input leakage current per I/O pin over recommended operating conditions where  $-0.3\text{ V} < V_{IN} < V_{IL}$ .
2.  $I_{IH}$  is the input leakage current per I/O pin over recommended operating conditions  $V_{IH} < V_{IN} < V_{CCI}$ . Input current is larger when operating outside recommended ranges.
3. Currents are measured at 100°C junction temperature and maximum voltage.
4. Currents are measured at 125°C junction temperature.



**Figure 2-19 • AC Loading**

**Table 2-137 • AC Waveforms, Measuring Points, and Capacitive Loads**

| Input Low (V) | Input High (V) | Measuring Point* (V) | VREF (typ.) (V) | VTT (typ.) (V) | C <sub>LOAD</sub> (pF) |
|---------------|----------------|----------------------|-----------------|----------------|------------------------|
| VREF − 0.1    | VREF + 0.1     | 0.75                 | 0.75            | 0.75           | 20                     |

**Note:** \*Measuring point =  $V_{trip}$ . See Table 2-29 on page 2-25 for a complete table of trip points.

## Timing Characteristics

**Table 2-138 • HSTL Class I**

**Military-Case Conditions:**  $T_J = 125^\circ\text{C}$ , Worst-Case VCC = 1.14 V,

**Worst-Case VCCI = 1.4 V, VREF = 0.75 V**

**Applicable to Pro I/Os for A3PE600L and A3PE3000L Only**

| Speed Grade | t <sub>DOUT</sub> | t <sub>DP</sub> | t <sub>DIN</sub> | t <sub>PY</sub> | t <sub>EOUT</sub> | t <sub>ZL</sub> | t <sub>ZH</sub> | t <sub>LZ</sub> | t <sub>HZ</sub> | t <sub>ZLS</sub> | t <sub>ZHS</sub> | Units |
|-------------|-------------------|-----------------|------------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|-------|
| Std.        | 0.80              | 3.15            | 0.05             | 2.76            | 0.52              | 3.20            | 3.11            | —               | —               | 5.41             | 5.32             | ns    |
| −1          | 0.68              | 2.68            | 0.05             | 2.34            | 0.44              | 2.73            | 2.65            | —               | —               | 4.60             | 4.52             | ns    |

**Note:** For specific junction temperature and voltage supply levels, refer to Table 2-6 on page 2-6 for derating values.

## Timing Characteristics

### 1.2 V DC Core Voltage

**Table 2-162 • LVDS**

**Military-Case Conditions:**  $T_J = 125^{\circ}\text{C}$ , Worst-Case VCC = 1.14 V, Worst-Case VCCI = 2.3 V  
**Applicable to Pro I/Os for A3PE600L and A3PE3000L Only**

| Speed Grade | $t_{\text{DOUT}}$ | $t_{\text{DP}}$ | $t_{\text{DIN}}$ | $t_{\text{PY}}$ | Units |
|-------------|-------------------|-----------------|------------------|-----------------|-------|
| Std.        | 0.80              | 1.87            | 0.05             | 2.48            | ns    |
| –1          | 0.68              | 1.59            | 0.05             | 2.11            | ns    |

*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

### 1.5 V DC Core Voltage

**Table 2-163 • LVDS**

**Military-Case Conditions:**  $T_J = 125^{\circ}\text{C}$ , VCC = 1.425 V, Worst-Case VCCI = 2.3 V  
**Applicable to Pro I/Os for A3PE600L and A3PE3000L Only**

| Speed Grade | $t_{\text{DOUT}}$ | $t_{\text{DP}}$ | $t_{\text{DIN}}$ | $t_{\text{PY}}$ | Units |
|-------------|-------------------|-----------------|------------------|-----------------|-------|
| Std.        | 0.61              | 1.75            | 0.04             | 2.18            | ns    |
| –1          | 0.52              | 1.48            | 0.03             | 1.86            | ns    |

*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-164 • LVDS**

**Military-Case Conditions:**  $T_J = 125^{\circ}\text{C}$ , Worst-Case VCC = 1.425 V, Worst-Case VCCI = 2.3 V  
**Applicable to Advanced I/O Banks for A3P250 and A3P1000 Only**

| Speed Grade | $t_{\text{DOUT}}$ | $t_{\text{DP}}$ | $t_{\text{DIN}}$ | $t_{\text{PY}}$ | Units |
|-------------|-------------------|-----------------|------------------|-----------------|-------|
| Std.        | 0.63              | 2.07            | 0.05             | 1.82            | ns    |
| –1          | 0.54              | 1.76            | 0.04             | 1.55            | ns    |

*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-7 on page 2-6](#) for derating values.

### Timing Characteristics

**Table 2-178 • Output Enable Register Propagation Delays**
**Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ , Worst-Case  $V_{CC} = 1.14\text{ V}$  for A3PE600L and A3PE3000L**

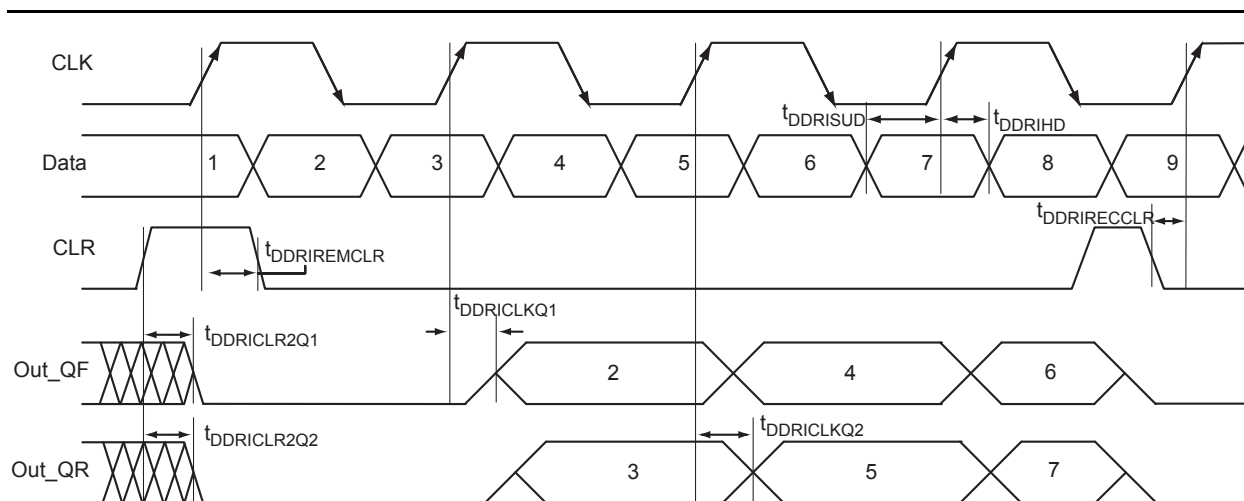
| Parameter      | Description                                                            | –1   | Std. | Units |
|----------------|------------------------------------------------------------------------|------|------|-------|
| $t_{OECLKQ}$   | Clock-to-Q of the Output Enable Register                               | 0.62 | 0.72 | ns    |
| $t_{OESUD}$    | Data Setup Time for the Output Enable Register                         | 0.43 | 0.51 | ns    |
| $t_{OEHD}$     | Data Hold Time for the Output Enable Register                          | 0.00 | 0.00 | ns    |
| $t_{OESUE}$    | Enable Setup Time for the Output Enable Register                       | 0.60 | 0.71 | ns    |
| $t_{OEHE}$     | Enable Hold Time for the Output Enable Register                        | 0.00 | 0.00 | ns    |
| $t_{OECLR2Q}$  | Asynchronous Clear-to-Q of the Output Enable Register                  | 0.92 | 1.08 | ns    |
| $t_{OEPRE2Q}$  | Asynchronous Preset-to-Q of the Output Enable Register                 | 0.92 | 1.08 | ns    |
| $t_{OEREMCLR}$ | Asynchronous Clear Removal Time for the Output Enable Register         | 0.00 | 0.00 | ns    |
| $t_{OERECCLR}$ | Asynchronous Clear Recovery Time for the Output Enable Register        | 0.31 | 0.36 | ns    |
| $t_{OEREMPRE}$ | Asynchronous Preset Removal Time for the Output Enable Register        | 0.00 | 0.00 | ns    |
| $t_{OERECPRE}$ | Asynchronous Preset Recovery Time for the Output Enable Register       | 0.31 | 0.36 | ns    |
| $t_{OEWCCLR}$  | Asynchronous Clear Minimum Pulse Width for the Output Enable Register  | 0.19 | 0.22 | ns    |
| $t_{OEWPPE}$   | Asynchronous Preset Minimum Pulse Width for the Output Enable Register | 0.19 | 0.22 | ns    |
| $t_{OECKMPWH}$ | Clock Minimum Pulse Width HIGH for the Output Enable Register          | 0.31 | 0.36 | ns    |
| $t_{OECKMPWL}$ | Clock Minimum Pulse Width LOW for the Output Enable Register           | 0.28 | 0.32 | ns    |

**Note:** For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-179 • Output Enable Register Propagation Delays**
**Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ ,  $V_{CC} = 1.425\text{ V}$  for A3PE600L and A3PE3000L**

| Parameter      | Description                                                            | –1   | Std. | Units |
|----------------|------------------------------------------------------------------------|------|------|-------|
| $t_{OECLKQ}$   | Clock-to-Q of the Output Enable Register                               | 0.47 | 0.55 | ns    |
| $t_{OESUD}$    | Data Setup Time for the Output Enable Register                         | 0.33 | 0.39 | ns    |
| $t_{OEHD}$     | Data Hold Time for the Output Enable Register                          | 0.00 | 0.00 | ns    |
| $t_{OESUE}$    | Enable Setup Time for the Output Enable Register                       | 0.46 | 0.54 | ns    |
| $t_{OEHE}$     | Enable Hold Time for the Output Enable Register                        | 0.00 | 0.00 | ns    |
| $t_{OECLR2Q}$  | Asynchronous Clear-to-Q of the Output Enable Register                  | 0.70 | 0.83 | ns    |
| $t_{OEPRE2Q}$  | Asynchronous Preset-to-Q of the Output Enable Register                 | 0.70 | 0.83 | ns    |
| $t_{OEREMCLR}$ | Asynchronous Clear Removal Time for the Output Enable Register         | 0.00 | 0.00 | ns    |
| $t_{OERECCLR}$ | Asynchronous Clear Recovery Time for the Output Enable Register        | 0.24 | 0.28 | ns    |
| $t_{OEREMPRE}$ | Asynchronous Preset Removal Time for the Output Enable Register        | 0.00 | 0.00 | ns    |
| $t_{OERECPRE}$ | Asynchronous Preset Recovery Time for the Output Enable Register       | 0.24 | 0.28 | ns    |
| $t_{OEWCCLR}$  | Asynchronous Clear Minimum Pulse Width for the Output Enable Register  | 0.19 | 0.22 | ns    |
| $t_{OEWPPE}$   | Asynchronous Preset Minimum Pulse Width for the Output Enable Register | 0.19 | 0.22 | ns    |
| $t_{OECKMPWH}$ | Clock Minimum Pulse Width HIGH for the Output Enable Register          | 0.31 | 0.36 | ns    |
| $t_{OECKMPWL}$ | Clock Minimum Pulse Width LOW for the Output Enable Register           | 0.28 | 0.32 | ns    |

**Note:** For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.


**Figure 2-34 • Input DDR Timing Diagram**

### Timing Characteristics

**Table 2-182 • Input DDR Propagation Delays**

Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ , Worst-Case  $V_{CC} = 1.14\text{ V}$  for A3PE600L and A3PE3000L

| Parameter               | Description                                          | -1   | Std. | Units |
|-------------------------|------------------------------------------------------|------|------|-------|
| $t_{\text{DDRCLKQ1}}$   | Clock-to-Out Out_QR for Input DDR                    | 0.38 | 0.45 | ns    |
| $t_{\text{DDRCLKQ2}}$   | Clock-to-Out Out_QF for Input DDR                    | 0.54 | 0.63 | ns    |
| $t_{\text{DDRISUD1}}$   | Data Setup for Input DDR (fall)                      | 0.39 | 0.46 | ns    |
| $t_{\text{DDRISUD2}}$   | Data Setup for Input DDR (rise)                      | 0.34 | 0.40 | ns    |
| $t_{\text{DDRHD1}}$     | Data Hold for Input DDR (fall)                       | 0.00 | 0.00 | ns    |
| $t_{\text{DDRHD2}}$     | Data Hold for Input DDR (rise)                       | 0.00 | 0.00 | ns    |
| $t_{\text{DDRCLR2Q1}}$  | Asynchronous Clear-to-Out Out_QR for Input DDR       | 0.64 | 0.75 | ns    |
| $t_{\text{DDRCLR2Q2}}$  | Asynchronous Clear-to-Out Out_QF for Input DDR       | 0.79 | 0.93 | ns    |
| $t_{\text{DDRREMCLR}}$  | Asynchronous Clear Removal Time for Input DDR        | 0.00 | 0.00 | ns    |
| $t_{\text{DDRRECCLR}}$  | Asynchronous Clear Recovery Time for Input DDR       | 0.31 | 0.36 | ns    |
| $t_{\text{DDRWCLR}}$    | Asynchronous Clear Minimum Pulse Width for Input DDR | 0.19 | 0.22 | ns    |
| $t_{\text{DDRICKMPWH}}$ | Clock Minimum Pulse Width HIGH for Input DDR         | 0.31 | 0.36 | ns    |
| $t_{\text{DDRICKMPWL}}$ | Clock Minimum Pulse Width LOW for Input DDR          | 0.28 | 0.32 | ns    |
| $F_{\text{DDRIMAX}}$    | Maximum Frequency for Input DDR                      | 160  | 160  | MHz   |

**Note:** For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.



**Table 2-187 • Output DDR Propagation Delays**
**Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ ,  $V_{CC} = 1.425\text{ V}$  for A3PE600L and A3PE3000L**

| Parameter               | Description                                           | –1   | Std. | Units |
|-------------------------|-------------------------------------------------------|------|------|-------|
| $t_{\text{DDROCLKQ}}$   | Clock-to-Out of DDR for Output DDR                    | 0.74 | 0.87 | ns    |
| $t_{\text{DDRISUD1}}$   | Data_F Data Setup for Output DDR                      | 0.40 | 0.47 | ns    |
| $t_{\text{DDROSUD2}}$   | Data_R Data Setup for Output DDR                      | 0.40 | 0.47 | ns    |
| $t_{\text{DDROHD1}}$    | Data_F Data Hold for Output DDR                       | 0.00 | 0.00 | ns    |
| $t_{\text{DDROHD2}}$    | Data_R Data Hold for Output DDR                       | 0.00 | 0.00 | ns    |
| $t_{\text{DDROCLR2Q}}$  | Asynchronous Clear-to-Out for Output DDR              | 0.85 | 1.00 | ns    |
| $t_{\text{DDROREMCLR}}$ | Asynchronous Clear Removal Time for Output DDR        | 0.00 | 0.00 | ns    |
| $t_{\text{DDRORECCLR}}$ | Asynchronous Clear Recovery Time for Output DDR       | 0.24 | 0.28 | ns    |
| $t_{\text{DDROWCLR1}}$  | Asynchronous Clear Minimum Pulse Width for Output DDR | 0.19 | 0.22 | ns    |
| $t_{\text{DDROCKMPWH}}$ | Clock Minimum Pulse Width HIGH for the Output DDR     | 0.31 | 0.36 | ns    |
| $t_{\text{DDROCKMPWL}}$ | Clock Minimum Pulse Width LOW for the Output DDR      | 0.28 | 0.32 | ns    |
| $F_{\text{DDROMAX}}$    | Maximum Frequency for the Output DDR                  | 250  | 250  | MHz   |

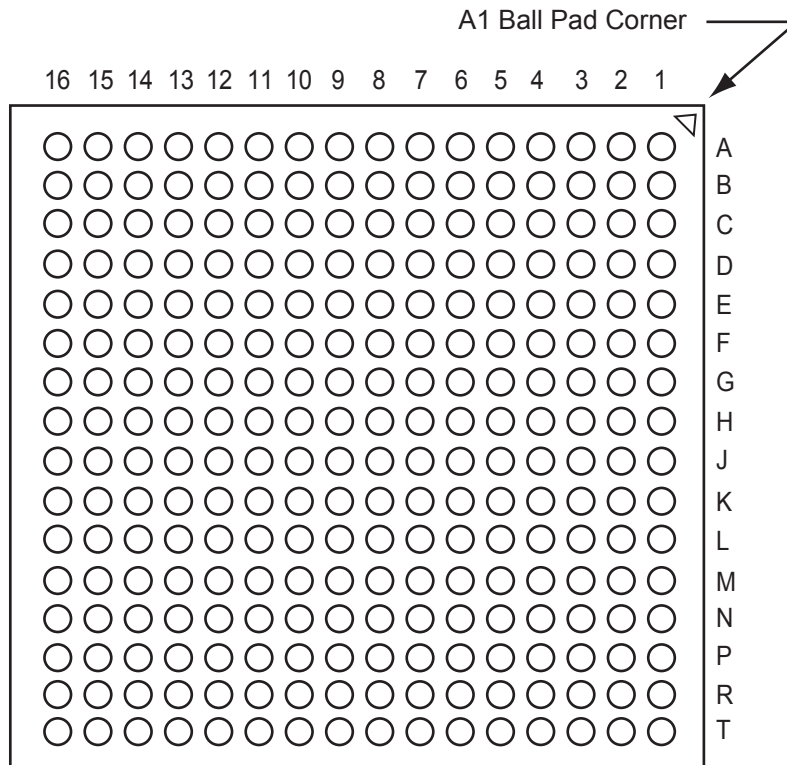
*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-6 on page 2-6](#) for derating values.

**Table 2-188 • Output DDR Propagation Delays**
**Military-Case Conditions:  $T_J = 125^{\circ}\text{C}$ , Worst-Case  $V_{CC} = 1.425\text{ V}$  for A3P250 and A3P1000**

| Parameter               | Description                                           | –1   | Std. | Units |
|-------------------------|-------------------------------------------------------|------|------|-------|
| $t_{\text{DDROCLKQ}}$   | Clock-to-Out of DDR for Output DDR                    | 0.84 | 0.99 | ns    |
| $t_{\text{DDRISUD1}}$   | Data_F Data Setup for Output DDR                      | 0.46 | 0.54 | ns    |
| $t_{\text{DDROSUD2}}$   | Data_R Data Setup for Output DDR                      | 0.46 | 0.54 | ns    |
| $t_{\text{DDROHD1}}$    | Data_F Data Hold for Output DDR                       | 0.00 | 0.00 | ns    |
| $t_{\text{DDROHD2}}$    | Data_R Data Hold for Output DDR                       | 0.00 | 0.00 | ns    |
| $t_{\text{DDROCLR2Q}}$  | Asynchronous Clear-to-Out for Output DDR              | 0.96 | 1.13 | ns    |
| $t_{\text{DDROREMCLR}}$ | Asynchronous Clear Removal Time for Output DDR        | 0.00 | 0.00 | ns    |
| $t_{\text{DDRORECCLR}}$ | Asynchronous Clear Recovery Time for Output DDR       | 0.27 | 0.31 | ns    |
| $t_{\text{DDROWCLR1}}$  | Asynchronous Clear Minimum Pulse Width for Output DDR | 0.25 | 0.30 | ns    |
| $t_{\text{DDROCKMPWH}}$ | Clock Minimum Pulse Width HIGH for the Output DDR     | 0.41 | 0.48 | ns    |
| $t_{\text{DDROCKMPWL}}$ | Clock Minimum Pulse Width LOW for the Output DDR      | 0.37 | 0.43 | ns    |
| $F_{\text{DDROMAX}}$    | Maximum Frequency for the Output DDR                  | 309  | 263  | MHz   |

*Note:* For specific junction temperature and voltage supply levels, refer to [Table 2-7 on page 2-6](#) for derating values.

## FG256



*Note:* This is the bottom view of the package.

### Note

For Package Manufacturing and Environmental information, visit the Resource Center at <http://www.microsemi.com/products/fpga-soc/solutions>.

| FG256      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| A1         | GND              |
| A2         | GAA0/IO00RSB0    |
| A3         | GAA1/IO01RSB0    |
| A4         | GAB0/IO02RSB0    |
| A5         | IO16RSB0         |
| A6         | IO22RSB0         |
| A7         | IO28RSB0         |
| A8         | IO35RSB0         |
| A9         | IO45RSB0         |
| A10        | IO50RSB0         |
| A11        | IO55RSB0         |
| A12        | IO61RSB0         |
| A13        | GBB1/IO75RSB0    |
| A14        | GBA0/IO76RSB0    |
| A15        | GBA1/IO77RSB0    |
| A16        | GND              |
| B1         | GAB2/IO224PDB3   |
| B2         | GAA2/IO225PDB3   |
| B3         | GNDQ             |
| B4         | GAB1/IO03RSB0    |
| B5         | IO17RSB0         |
| B6         | IO21RSB0         |
| B7         | IO27RSB0         |
| B8         | IO34RSB0         |
| B9         | IO44RSB0         |
| B10        | IO51RSB0         |
| B11        | IO57RSB0         |
| B12        | GBC1/IO73RSB0    |
| B13        | GBB0/IO74RSB0    |
| B14        | IO71RSB0         |
| B15        | GBA2/IO78PDB1    |
| B16        | IO81PDB1         |
| C1         | IO224NDB3        |
| C2         | IO225NDB3        |
| C3         | VMV3             |
| C4         | IO11RSB0         |
| C5         | GAC0/IO04RSB0    |
| C6         | GAC1/IO05RSB0    |

| FG256      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| C7         | IO25RSB0         |
| C8         | IO36RSB0         |
| C9         | IO42RSB0         |
| C10        | IO49RSB0         |
| C11        | IO56RSB0         |
| C12        | GBC0/IO72RSB0    |
| C13        | IO62RSB0         |
| C14        | VMV0             |
| C15        | IO78NDB1         |
| C16        | IO81NDB1         |
| D1         | IO222NDB3        |
| D2         | IO222PDB3        |
| D3         | GAC2/IO223PDB3   |
| D4         | IO223NDB3        |
| D5         | GNDQ             |
| D6         | IO23RSB0         |
| D7         | IO29RSB0         |
| D8         | IO33RSB0         |
| D9         | IO46RSB0         |
| D10        | IO52RSB0         |
| D11        | IO60RSB0         |
| D12        | GNDQ             |
| D13        | IO80NDB1         |
| D14        | GBB2/IO79PDB1    |
| D15        | IO79NDB1         |
| D16        | IO82NSB1         |
| E1         | IO217PDB3        |
| E2         | IO218PDB3        |
| E3         | IO221NDB3        |
| E4         | IO221PDB3        |
| E5         | VMV0             |
| E6         | VCCIB0           |
| E7         | VCCIB0           |
| E8         | IO38RSB0         |
| E9         | IO47RSB0         |
| E10        | VCCIB0           |
| E11        | VCCIB0           |
| E12        | VMV1             |

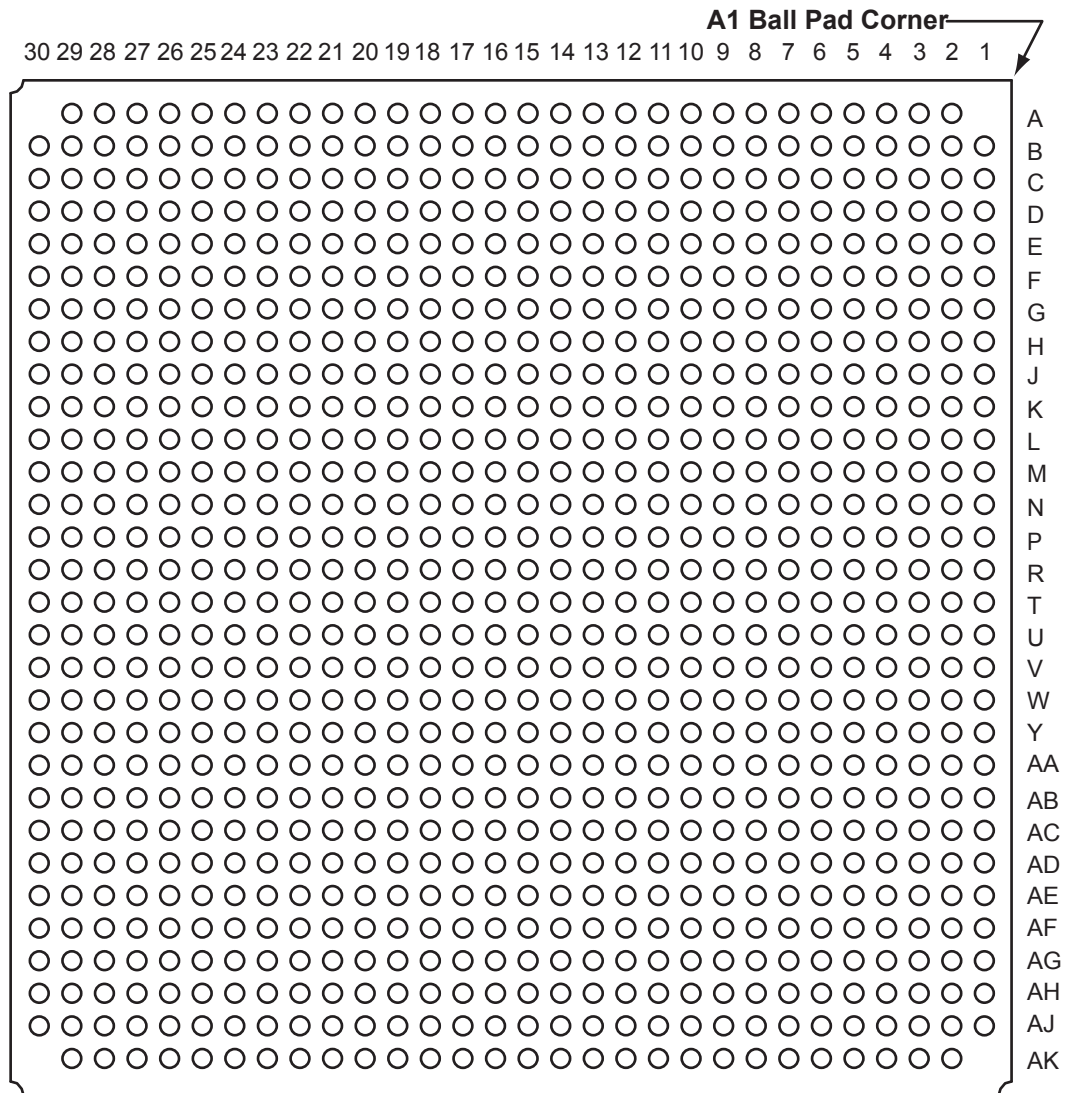
| FG256      |                  |
|------------|------------------|
| Pin Number | A3P1000 Function |
| E13        | GBC2/IO80PDB1    |
| E14        | IO83PPB1         |
| E15        | IO86PPB1         |
| E16        | IO87PDB1         |
| F1         | IO217NDB3        |
| F2         | IO218NDB3        |
| F3         | IO216PDB3        |
| F4         | IO216NDB3        |
| F5         | VCCIB3           |
| F6         | GND              |
| F7         | VCC              |
| F8         | VCC              |
| F9         | VCC              |
| F10        | VCC              |
| F11        | GND              |
| F12        | VCCIB1           |
| F13        | IO83NPB1         |
| F14        | IO86NPB1         |
| F15        | IO90PPB1         |
| F16        | IO87NDB1         |
| G1         | IO210PSB3        |
| G2         | IO213NDB3        |
| G3         | IO213PDB3        |
| G4         | GFC1/IO209PPB3   |
| G5         | VCCIB3           |
| G6         | VCC              |
| G7         | GND              |
| G8         | GND              |
| G9         | GND              |
| G10        | GND              |
| G11        | VCC              |
| G12        | VCCIB1           |
| G13        | GCC1/IO91PPB1    |
| G14        | IO90NPB1         |
| G15        | IO88PDB1         |
| G16        | IO88NDB1         |
| H1         | GFB0/IO208NPB3   |
| H2         | GFA0/IO207NDB3   |

| <b>FG256</b>      |                         |
|-------------------|-------------------------|
| <b>Pin Number</b> | <b>A3P1000 Function</b> |
| R5                | IO168RSB2               |
| R6                | IO163RSB2               |
| R7                | IO157RSB2               |
| R8                | IO149RSB2               |
| R9                | IO143RSB2               |
| R10               | IO138RSB2               |
| R11               | IO131RSB2               |
| R12               | IO125RSB2               |
| R13               | GDB2/IO115RSB2          |
| R14               | TDI                     |
| R15               | GNDQ                    |
| R16               | TDO                     |
| T1                | GND                     |
| T2                | IO183RSB2               |
| T3                | GEB2/IO186RSB2          |
| T4                | IO172RSB2               |
| T5                | IO170RSB2               |
| T6                | IO164RSB2               |
| T7                | IO158RSB2               |
| T8                | IO153RSB2               |
| T9                | IO142RSB2               |
| T10               | IO135RSB2               |
| T11               | IO130RSB2               |
| T12               | GDC2/IO116RSB2          |
| T13               | IO120RSB2               |
| T14               | GDA2/IO114RSB2          |
| T15               | TMS                     |
| T16               | GND                     |

| FG484      |                   | FG484      |                   | FG484      |                   |
|------------|-------------------|------------|-------------------|------------|-------------------|
| Pin Number | A3PE600L Function | Pin Number | A3PE600L Function | Pin Number | A3PE600L Function |
| A1         | GND               | B14        | NC                | D5         | GAA0/IO00NDB0V0   |
| A2         | GND               | B15        | NC                | D6         | GAA1/IO00PDB0V0   |
| A3         | VCCIB0            | B16        | IO30NDB1V1        | D7         | GAB0/IO01NDB0V0   |
| A4         | IO06NDB0V1        | B17        | IO30PDB1V1        | D8         | IO05PDB0V0        |
| A5         | IO06PDB0V1        | B18        | IO32PDB1V1        | D9         | IO10PDB0V1        |
| A6         | IO08NDB0V1        | B19        | NC                | D10        | IO12PDB0V2        |
| A7         | IO08PDB0V1        | B20        | NC                | D11        | IO16NDB0V2        |
| A8         | IO11PDB0V1        | B21        | VCCIB2            | D12        | IO23NDB1V0        |
| A9         | IO17PDB0V2        | B22        | GND               | D13        | IO23PDB1V0        |
| A10        | IO18NDB0V2        | C1         | VCCIB7            | D14        | IO28NDB1V1        |
| A11        | IO18PDB0V2        | C2         | NC                | D15        | IO28PDB1V1        |
| A12        | IO22PDB1V0        | C3         | NC                | D16        | GBB1/IO34PDB1V1   |
| A13        | IO26PDB1V0        | C4         | NC                | D17        | GBA0/IO35NDB1V1   |
| A14        | IO29NDB1V1        | C5         | GND               | D18        | GBA1/IO35PDB1V1   |
| A15        | IO29PDB1V1        | C6         | IO04NDB0V0        | D19        | GND               |
| A16        | IO31NDB1V1        | C7         | IO04PDB0V0        | D20        | NC                |
| A17        | IO31PDB1V1        | C8         | VCC               | D21        | NC                |
| A18        | IO32NDB1V1        | C9         | VCC               | D22        | NC                |
| A19        | NC                | C10        | IO14NDB0V2        | E1         | NC                |
| A20        | VCCIB1            | C11        | IO19NDB0V2        | E2         | NC                |
| A21        | GND               | C12        | NC                | E3         | GND               |
| A22        | GND               | C13        | NC                | E4         | GAB2/IO133PDB7V1  |
| B1         | GND               | C14        | VCC               | E5         | GAA2/IO134PDB7V1  |
| B2         | VCCIB7            | C15        | VCC               | E6         | GNDQ              |
| B3         | NC                | C16        | NC                | E7         | GAB1/IO01PDB0V0   |
| B4         | IO03NDB0V0        | C17        | NC                | E8         | IO05NDB0V0        |
| B5         | IO03PDB0V0        | C18        | GND               | E9         | IO10NDB0V1        |
| B6         | IO07NDB0V1        | C19        | NC                | E10        | IO12NDB0V2        |
| B7         | IO07PDB0V1        | C20        | NC                | E11        | IO16PDB0V2        |
| B8         | IO11NDB0V1        | C21        | NC                | E12        | IO20NDB1V0        |
| B9         | IO17NDB0V2        | C22        | VCCIB2            | E13        | IO24NDB1V0        |
| B10        | IO14PDB0V2        | D1         | NC                | E14        | IO24PDB1V0        |
| B11        | IO19PDB0V2        | D2         | NC                | E15        | GBC1/IO33PDB1V1   |
| B12        | IO22NDB1V0        | D3         | NC                | E16        | GBB0/IO34NDB1V1   |
| B13        | IO26NDB1V0        | D4         | GND               | E17        | GNDQ              |

| FG484      |                  | FG484      |                  | FG484      |                  |
|------------|------------------|------------|------------------|------------|------------------|
| Pin Number | A3P1000 Function | Pin Number | A3P1000 Function | Pin Number | A3P1000 Function |
| A1         | GND              | B14        | IO58RSB0         | D5         | GAA0/IO00RSB0    |
| A2         | GND              | B15        | IO63RSB0         | D6         | GAA1/IO01RSB0    |
| A3         | VCCIB0           | B16        | IO66RSB0         | D7         | GAB0/IO02RSB0    |
| A4         | IO07RSB0         | B17        | IO68RSB0         | D8         | IO16RSB0         |
| A5         | IO09RSB0         | B18        | IO70RSB0         | D9         | IO22RSB0         |
| A6         | IO13RSB0         | B19        | NC               | D10        | IO28RSB0         |
| A7         | IO18RSB0         | B20        | NC               | D11        | IO35RSB0         |
| A8         | IO20RSB0         | B21        | VCCIB1           | D12        | IO45RSB0         |
| A9         | IO26RSB0         | B22        | GND              | D13        | IO50RSB0         |
| A10        | IO32RSB0         | C1         | VCCIB3           | D14        | IO55RSB0         |
| A11        | IO40RSB0         | C2         | IO220PDB3        | D15        | IO61RSB0         |
| A12        | IO41RSB0         | C3         | NC               | D16        | GBB1/IO75RSB0    |
| A13        | IO53RSB0         | C4         | NC               | D17        | GBA0/IO76RSB0    |
| A14        | IO59RSB0         | C5         | GND              | D18        | GBA1/IO77RSB0    |
| A15        | IO64RSB0         | C6         | IO10RSB0         | D19        | GND              |
| A16        | IO65RSB0         | C7         | IO14RSB0         | D20        | NC               |
| A17        | IO67RSB0         | C8         | VCC              | D21        | NC               |
| A18        | IO69RSB0         | C9         | VCC              | D22        | NC               |
| A19        | NC               | C10        | IO30RSB0         | E1         | IO219NDB3        |
| A20        | VCCIB0           | C11        | IO37RSB0         | E2         | NC               |
| A21        | GND              | C12        | IO43RSB0         | E3         | GND              |
| A22        | GND              | C13        | NC               | E4         | GAB2/IO224PDB3   |
| B1         | GND              | C14        | VCC              | E5         | GAA2/IO225PDB3   |
| B2         | VCCIB3           | C15        | VCC              | E6         | GNDQ             |
| B3         | NC               | C16        | NC               | E7         | GAB1/IO03RSB0    |
| B4         | IO06RSB0         | C17        | NC               | E8         | IO17RSB0         |
| B5         | IO08RSB0         | C18        | GND              | E9         | IO21RSB0         |
| B6         | IO12RSB0         | C19        | NC               | E10        | IO27RSB0         |
| B7         | IO15RSB0         | C20        | NC               | E11        | IO34RSB0         |
| B8         | IO19RSB0         | C21        | NC               | E12        | IO44RSB0         |
| B9         | IO24RSB0         | C22        | VCCIB1           | E13        | IO51RSB0         |
| B10        | IO31RSB0         | D1         | IO219PDB3        | E14        | IO57RSB0         |
| B11        | IO39RSB0         | D2         | IO220NDB3        | E15        | GBC1/IO73RSB0    |
| B12        | IO48RSB0         | D3         | NC               | E16        | GBB0/IO74RSB0    |
| B13        | IO54RSB0         | D4         | GND              | E17        | IO71RSB0         |

## FG896



*Note:* This is the bottom view.

### Note

For Package Manufacturing and Environmental information, visit the Resource Center at <http://www.microsemi.com/products/fpga-soc/solutions>.

| FG896      |                     |
|------------|---------------------|
| Pin Number | A3PE3000L Function  |
| AG5        | IO220PPB5V3         |
| AG6        | IO228PDB5V4         |
| AG7        | IO231NDB5V4         |
| AG8        | GEC2/IO231PDB5V4    |
| AG9        | IO225NPB5V3         |
| AG10       | IO223NPB5V3         |
| AG11       | IO221PDB5V3         |
| AG12       | IO221NDB5V3         |
| AG13       | IO205NPB5V1         |
| AG14       | IO199NDB5V0         |
| AG15       | IO199PDB5V0         |
| AG16       | IO187NDB4V4         |
| AG17       | IO187PDB4V4         |
| AG18       | IO181NDB4V3         |
| AG19       | IO171PPB4V2         |
| AG20       | IO165NPB4V1         |
| AG21       | IO161NPB4V0         |
| AG22       | IO159NDB4V0         |
| AG23       | IO159PDB4V0         |
| AG24       | IO158PPB4V0         |
| AG25       | GDB2/IO155PDB4V0    |
| AG26       | GDA2/IO154PPB4V0    |
| AG27       | GND                 |
| AG28       | VJTAG               |
| AG29       | VCC                 |
| AG30       | IO149NDB3V4         |
| AH1        | GND                 |
| AH2        | IO233NPB5V4         |
| AH3        | VCC                 |
| AH4        | FF/GEB2/IO232PPB5V4 |
| AH5        | VCCIB5              |
| AH6        | IO219NDB5V3         |
| AH7        | IO219PDB5V3         |
| AH8        | IO227NDB5V4         |
| AH9        | IO227PDB5V4         |

| FG896      |                    |
|------------|--------------------|
| Pin Number | A3PE3000L Function |
| AH10       | IO225PPB5V3        |
| AH11       | IO223PPB5V3        |
| AH12       | IO211NDB5V2        |
| AH13       | IO211PDB5V2        |
| AH14       | IO205PPB5V1        |
| AH15       | IO195NDB5V0        |
| AH16       | IO185NDB4V3        |
| AH17       | IO185PDB4V3        |
| AH18       | IO181PDB4V3        |
| AH19       | IO177NDB4V2        |
| AH20       | IO171NPB4V2        |
| AH21       | IO165PPB4V1        |
| AH22       | IO161PPB4V0        |
| AH23       | IO157NDB4V0        |
| AH24       | IO157PDB4V0        |
| AH25       | IO155NDB4V0        |
| AH26       | VCCIB4             |
| AH27       | TDI                |
| AH28       | VCC                |
| AH29       | VPUMP              |
| AH30       | GND                |
| AJ1        | GND                |
| AJ2        | GND                |
| AJ3        | GEA2/IO233PPB5V4   |
| AJ4        | VCC                |
| AJ5        | IO217NPB5V2        |
| AJ6        | VCC                |
| AJ7        | IO215NPB5V2        |
| AJ8        | IO213NDB5V2        |
| AJ9        | IO213PDB5V2        |
| AJ10       | IO209NDB5V1        |
| AJ11       | IO209PDB5V1        |
| AJ12       | IO203NDB5V1        |
| AJ13       | IO203PDB5V1        |
| AJ14       | IO197NDB5V0        |
| AJ15       | IO195PDB5V0        |

| FG896      |                    |
|------------|--------------------|
| Pin Number | A3PE3000L Function |
| AJ16       | IO183NDB4V3        |
| AJ17       | IO183PDB4V3        |
| AJ18       | IO179NPB4V3        |
| AJ19       | IO177PDB4V2        |
| AJ20       | IO173NDB4V2        |
| AJ21       | IO173PDB4V2        |
| AJ22       | IO163NDB4V1        |
| AJ23       | IO163PDB4V1        |
| AJ24       | IO167NPB4V1        |
| AJ25       | VCC                |
| AJ26       | IO156NPB4V0        |
| AJ27       | VCC                |
| AJ28       | TMS                |
| AJ29       | GND                |
| AJ30       | GND                |
| AK2        | GND                |
| AK3        | GND                |
| AK4        | IO217PPB5V2        |
| AK5        | GND                |
| AK6        | IO215PPB5V2        |
| AK7        | GND                |
| AK8        | IO207NDB5V1        |
| AK9        | IO207PDB5V1        |
| AK10       | IO201NDB5V0        |
| AK11       | IO201PDB5V0        |
| AK12       | IO193NDB4V4        |
| AK13       | IO193PDB4V4        |
| AK14       | IO197PDB5V0        |
| AK15       | IO191NDB4V4        |
| AK16       | IO191PDB4V4        |
| AK17       | IO189NDB4V4        |
| AK18       | IO189PDB4V4        |
| AK19       | IO179PPB4V3        |
| AK20       | IO175NDB4V2        |
| AK21       | IO175PDB4V2        |
| AK22       | IO169NDB4V1        |



| <b>FG896</b>      |                           |
|-------------------|---------------------------|
| <b>Pin Number</b> | <b>A3PE3000L Function</b> |
| U8                | IO265NDB6V3               |
| U9                | IO263NDB6V3               |
| U10               | VCCIB6                    |
| U11               | VCC                       |
| U12               | GND                       |
| U13               | GND                       |
| U14               | GND                       |
| U15               | GND                       |
| U16               | GND                       |
| U17               | GND                       |
| U18               | GND                       |
| U19               | GND                       |
| U20               | VCC                       |
| U21               | VCCIB3                    |
| U22               | IO120PDB3V0               |
| U23               | IO128PDB3V1               |
| U24               | IO124PDB3V1               |
| U25               | IO124NDB3V1               |
| U26               | IO126PDB3V1               |
| U27               | IO129PDB3V1               |
| U28               | IO127PDB3V1               |
| U29               | IO125PDB3V1               |
| U30               | IO121NDB3V0               |
| V1                | IO268NDB6V4               |
| V2                | IO262PDB6V3               |
| V3                | IO260PDB6V3               |
| V4                | IO252PDB6V2               |
| V5                | IO257NPB6V2               |
| V6                | IO261NPB6V3               |
| V7                | IO255PDB6V2               |
| V8                | IO259PDB6V3               |
| V9                | IO259NDB6V3               |
| V10               | VCCIB6                    |
| V11               | VCC                       |
| V12               | GND                       |
| V13               | GND                       |